

Debris Avalanches and Debris Flows Transformed from Collapses in the Trans-Mexican Volcanic Belt, Mexico

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Volcanoes of the Trans-Mexican Volcanic Belt (TMVB) have yielded numerous sector and flank collapses during Pleistocene and Holocene time. Sector collapses associated with magmatic activity have yielded debris avalanches with generally limited runout extent (e.g. Popocatepetl, Jocotitlán, and Colima volcanoes). In contrast, flank collapses (smaller failures not involving the volcano summit), both associated and unassociated with magmatic activity and correlated with intense hydrothermal alteration in ice-capped volcanoes, commonly have yielded highly mobile cohesive debris flows (e.g. Pico de Orizaba and Nevado de Toluca volcanoes).

Collapse orientation in the TMVB is preferentially to the south and north-east, probably reflecting the tectonic regime of active E-W and NNW faults. The different mobilities of the flows transformed from collapses have important implications for hazard assessment. Both sector and flank collapse can yield highly mobile debris flows, but this transformation is more common in the case of the smaller failures. High mobility is related to factors such as water and clay content of the failed material, the paleotopography, and the extent of entrainment of sediment during flow (bulking).

Both debris-avalanches and debris-flows are volcanic hazards that occur from both active volcanoes, as well as those that are inactive or dormant volcanoes, and may be triggered by earthquakes, precipitation, or simple gravity. There will be no precursory warning in such non-volcanic cases.